MAIL STOP PCT
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Title of the Invention: Method of Interconnecting Terminals and Method of Mounting Semiconductor Devices

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Attached is a translation of the Annexes to the International Preliminary Examination Report issued pursuant to PCT Article 36.

In addition, with electronic devices which are extremely weak against static electricity, the application of an electric field from the outside thereof and arraying of the electrically conductive particles creates problems with respect to reliability of the electronic devices.

The present invention was made in order to solve the above-described problems of the prior art, and its object is to provide a method of interconnecting terminals which can guarantee adequate electrical connection between terminals such as opposing electrodes and which can obtain the same level of electrical resistance between terminals as with a metal connection as well as a mounting method for semiconductor devices using this connecting method.

A method of interconnecting terminals according to the present invention is characterized by including a terminal placement step in which terminals are placed opposite each other with a resin composition containing low melting point metal fillers which comprises at least electrically conductive particles and a resin component which is not completely cured at the melting point of the electrically conductive particles therebetween, a resin heating step in which the resin containing metal fillers is heated to a temperature which is higher than the melting point of the electrically conductive particles and at which the resin component is not completely cured, and a resin component curing step in which the resin component is cured, wherein in the heating step, the electrically conductive particles collect or coalesce in the region between the electrodes by melting and agglomeration of the electrically conductive particles, and the terminals are electrically interconnected.

According to the present invention, the anisotropic electrically conductive resin composition is heated to a temperature higher than the melting point of the electrically conductive particles, and at this temperature, the electrically conductive particles in the resin component which is not completely cured are melted. Since the electrically conductive particles can freely move inside the

resin component, the molten electrically conductive particles spread on the terminal surface, which is the interface between the terminals and the anisotropic electrically conductive resin, and a "wetted" state takes place. The molten

terminals can be obtained.

According to yet another mode of the present invention, the resin component is a resin having reducing properties which can reduce at least one of the surface of the terminals and the surface of the electrically conductive particles.

According to this mode, since the resin component has reducing properties with respect to the surface of the terminals and the surface of the electrically conductive particles, it can activate the surface of the terminals and the surface of the electrically conductive particles. As a result, if an anisotropic electrically conductive resin composition containing the resin component having reducing properties is used, the surface of the terminals or the surface of the electrically conductive particles is reduced and the surface is activated. It becomes easier, therefore, to bond the surface of the terminals to the electrically conductive particles, and it becomes easier to bond the electrically conductive particles to each other. Thus, bonding by the electrically conductive particles between opposing terminals can be performed with greater certainty, and the reliability of the conducting paths formed between terminals can be increased.

According to yet another mode of the present invention, in the terminal placement step, the resin containing metal fillers may be supplied so as to achieve a state in which the resin containing metal fillers fills the entire space between opposing members on which the terminals are provided including the space between each of the opposing terminals.

According to this mode, after the heating and curing of the anisotropic electrically conductive resin composition which fills the entire space between opposing members having the terminals, the electrically conductive particles agglomerate at the terminal portions, and in locations other than the terminals, only the resin remains. In this manner, the terminals are metallically bonded to each other, and adjoining terminals are insulated from each other by the resin

material. Adhesive bonding is achieved to guarantee an adequate bonding strength.

As a result, the process of supplying the anisotropic electrically conductive resin composition becomes easier, the number of process steps is greatly reduced, and metal bonding and resin bonding can be simultaneously achieved. In addition, low temperature working becomes possible when interconnecting terminals.

A method of mounting a semiconductor device according to the present invention is characterized by including an electrode placement step in which electrode pads of a semiconductor chip and circuit electrodes on a circuit substrate which are provided to correspond to the electrode pads are placed so as to oppose each other with a resin composition containing low melting point metal fillers comprising at least electrically conductive particles and a resin component therebetween, a resin heating step in which the resin containing metal fillers is heated to a temperature which is higher than the melting point of the electrically conductive particles and at which the resin component is not completely cured, and a resin component curing step in which the resin component is cured, wherein in the heating step, the electrically conductive particles collect or coalesce towards the region between the electrodes by melting and agglomeration of the electrically conductive particles, and the terminals are electrically interconnected.

According to this method, when electrode pads of a semiconductor chip and circuit electrodes on a circuit substrate are electrically connected in a semiconductor device, the above-described method of interconnecting terminals can be used. As a result, a mounting method can be provided which can cope with the trend toward finer pitch in recent semiconductor chips and similar devices. Accordingly, the yield of semiconductor devices can be increased.

In this case, by using electrically conductive particles having a relatively low melting point, the heating temperature when mounting a semiconductor chip

on a circuit substrate can be set to a low level. As a result, a mounting method for a semiconductor device according to the present invention can suitably be

Claims

1. A method of interconnecting terminals characterized by including a terminal placement step of placing terminals so as to oppose each other with an anisotropic electrically conductive resin composition comprising at least electrically conductive particles and a resin component which is not completely cured at the melting point of the electrically conductive particles therebetween,

a resin heating step of heating the resin containing metal fillers to a temperature which is higher than the melting point of the electrically conductive particles and at which the resin component is not completely cured, and

a resin component curing step of curing the resin component,

wherein in the heating step, the electrically conductive particles collect in the region between the electrodes by melting and agglomeration of the electrically conductive particles, and the terminals are electrically interconnected.

2.(delete)

3. A method of interconnecting terminals as set forth in claim 1 characterized in that the resin component is a resin having reducing properties which reduce at least one of the surface of the terminals and the surface of the electrically conductive particles.

4.(delete)

5. A method of interconnecting terminals as set forth in claim 1 or claim 3 characterized in that in the terminal placement step, the resin containing metal fillers is supplied so as to achieve a state in which the resin containing metal fillers completely fills the space between members on which the terminals are provided including the space between opposing terminals.

6. A method of mounting a semiconductor device characterized by including an electrode placement step in which electrode pads of a semiconductor chip and circuit electrodes provided on a circuit substrate so as to correspond to the electrode pads are placed opposite each other with an anisotropic electrically conductive resin composition comprising at least electrically conductive particles and a resin component therebetween,

a resin heating step in which the resin containing metal fillers is heated to a temperature higher than the melting point of the electrically conductive particles and at which the resin component is not completely cured, and

a resin component curing step in which the resin component is cured,

wherein in the heating step, the electrically conductive particles collect between the electrodes by melting and agglomeration of the electrically conductive particles, and the terminals are electrically interconnected.

7. A mounting method for a semiconductor device as set forth in claim 6 characterized in that in the electrode placement step, the resin containing metal fillers is supplied so as to achieve a state in which the resin containing metal fillers completely fill the space between the semiconductor chip and the circuit substrate including the space between the opposing electrode pads and circuit electrodes.